

U.S FISH & WILDLIFE SERVICE

CRAB ORCHARD

NATIONAL WILDLIFE REFUGE

REPORT ON WILDERNESS CHARACTER MONITORING



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INTRODUCTION

This report offers a detailed summary of the baseline Crab Orchard Wilderness character monitoring assessment; conducted during the summer of 2012 through the U.S. Fish and Wildlife Service, Wilderness Fellows program. An interagency team, representing the U.S. Fish & Wildlife Service, National Park Service, U.S. Forest Service, and Bureau of Land Management, developed the wilderness character monitoring framework applied throughout this process. This national strategy is described in the 2008 “Keeping It Wild: An Interagency Strategy to Monitor Trends in Wilderness Character across the National Wilderness Preservation System” publication.

The passing of the Wilderness Act of 1964 required that the Secretary of the Interior review every road-less area of 5,000 contiguous acres or more or of sufficient size to make practicable its preservation and use in an unimpaired condition. The Crab Orchard Wilderness was found to be the most inaccessible and isolated area on the Refuge, and was proven suitable for inclusion in the National Wilderness Preservation System.

The year of 2014 marks the 50th anniversary of the Wilderness Act, and it is the intent of the National Wilderness Preservation System, of which the U.S. Fish and Wildlife Service is a part, to develop monitoring plans and collect data for every congressionally designated wilderness area in the United States. The purpose of this document is to provide the Crab Orchard National Wildlife Refuge staff with the comprehensive means of tracking and evaluating the state of the Crab Orchard Wilderness over time.

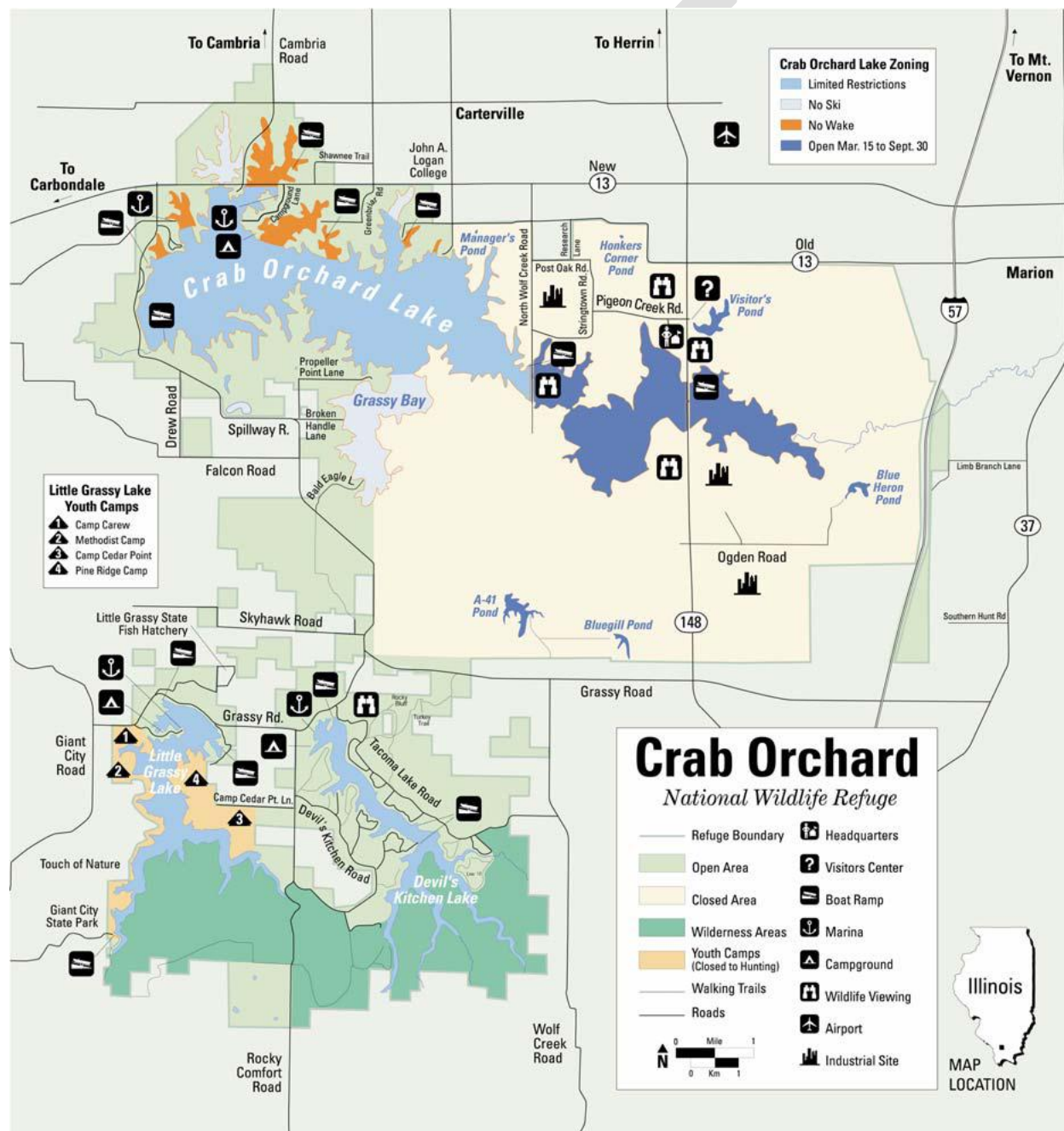
GEOGRAPHIC SETTING

The Crab Orchard National Wildlife Refuge is located in southern Illinois, 50 miles north of the confluence of the Mississippi and Ohio Rivers. The refuge currently totals 43,888 acres with property in Jackson, Union, and the majority of acreage in Williamson Counties. Numerous cities surround the Refuge. In the northeast corner is Marion with a population of approximately 17,000 and just west of the refuge is Carbondale with about 26,000. St. Louis is within easy driving distance to the northwest. Total population of the three counties adjacent to the refuge is in excess of 145,000. In addition to Crab Orchard NWR, a variety of other state and federal agencies manage land lie within the vicinity of the Refuge.

The 4,050-acre Crab Orchard Wilderness is located in the extreme southern portion of the Refuge. The entire northern boundary and almost the entire western boundary of the wilderness border other Refuge land. Much of the northern boundary is formed by Little Grassy and Devils Kitchen lakes, which are man-made reservoirs. Lands on the southern boundary of the Wilderness include the 779-acre Panther Den Wilderness managed by the USDA Forest Service. Additional lands are owned by Southern Illinois University and private individuals. Neighboring lands on the eastern boundary are primarily fields in private ownership.

At the time of designation, the Wilderness excluded an inholding and another parcel surrounded by Wilderness on three sides, both owned by Southern Illinois University. Through a land exchange in 1979, the Refuge acquired these parcels which total about 120 acres. An additional 558-acre tract contiguous with the southern boundary of the Wilderness was acquired in the same exchange. These tracts currently remain under Refuge ownership and are managed as a buffer for the wilderness.

Figure 1: Crab Orchard NWR



ECOLOGICAL SETTING

The Crab Orchard National Wildlife Refuge virtually straddles the divide between two of Illinois's physiographic regions. Low relief, broad valleys, and relatively well-developed drainage systems characterize the terrain of the northern portion of the Refuge. This represents the most widespread area of glacial deposits in the State. Extensive hardwood forests, interspersed with large areas of prairie upland, contribute to the landscape character of this region.

In contrast, the southern portion of the Refuge, containing Crab Orchard's Wilderness, is an extension of the massive Ozark Mountain System of Missouri and Arkansas called the Shawnee Hills. Uplands with narrow ridges dissected by deep, narrow valleys with steep slopes and numerous sandstone outcrops. This unique transformation in the landscape of Southern Illinois is a result of the Wisconsin glacial age.

The climate of the area is typical of the mid-western region of the United States in which frequent weather changes occur from day-to-day and season-to-season. The weather is governed by cold air moving southward across the plains from Canada, warm moisture-laden air moving up from the Gulf of Mexico, and dry air from the west and southwest. Summers are generally hot and humid, and winters are normally mild. Mean monthly temperatures range from 35 to 79 degrees Fahrenheit. The average frost-free dates in spring and fall for the area are April 15 and October 22. Average annual rainfall totals approximately 44 inches.

The vegetation cover in the Crab Orchard Wilderness is predominantly second growth deciduous forest on slopes and typical old-fields with scattered trees, brush and small grassy openings along ridges. There are more than 700 acres of plantations, including 400 acres of hardwood (mostly black-locust) and 325 acres of non-native pine and pine-hardwood. Invasive species, such as autumn-olive, multiflora rose, and Japanese honeysuckle, are common throughout the Wilderness and likely to become more problematic.



ESTABLISHING THE CRAB ORCHARD WILDERNESS

The establishment of the Crab Orchard National Wildlife Refuge encompasses a unique history. President Franklin D. Roosevelt first authorized the Crab Orchard Creek Project in 1936 as a Works Progress Administration (WPA) project. The intention of this project was recreational and conservation efforts for water, soil and forestry conservation. From 1932 to 1937 the federal government had purchased 32,000 acres within the Project area from private landowners. Over 80 percent of the acquired land had been cleared, and used for agricultural

crops and grazing. Civilian Conservation Corps (CCC) workers planted more than 4.6 million trees in the area from 1938 to 1941.

The Crab Orchard Lake dam was completed in 1941 forming the largest lake in Illinois at the time. This lake remains as a defining feature of Crab Orchard. In 1942, the Department of War appropriated 10,223 acres of the Crab Orchard Creek Project land and purchased an additional 12,352 acres to build the Illinois Ordnance Plant. The plant, known as Ordill, manufactured bombs and anti-tank mines during World War II. Remnants of these munitions operations remain on the Refuge's restricted areas in the form of underground bunkers, old buildings, and smaller active munitions plants.

The Wilderness Act of 1964 directed the study of every roadless area of 5,000 acres or more within the National Wildlife Refuge System to determine suitability or unsuitability of each such area for inclusion in the National Wilderness Preservation System. In 1973, a Wilderness Study Summary was completed on the Refuge, which launched the process for establishing a 4,050-acre parcel as wilderness. Congress designated the Crab Orchard Wilderness as a unit of the National Wilderness Preservation System on October 19, 1976, when it enacted Public Law 94-557.

Completion of the Crab Orchard Wilderness Management Plan, WMP, in 1979 presented a large restoration undertaking which could be considered vital to the undeveloped quality of the wilderness. The job involved the removal of Road 9a. This work required the use of heavy machinery in order to break up and remove the asphalt. Work began in 1980 and was completed in 1981 with the transplanting of native trees and shrubs as a final effort to help spur natural succession.

The residual pine plantations, created during the late 1930s by the CCC workers, were also intended to be selectively removed using hand tools and herbicide injection. This would help return the forest to the pre-European condition of upland hardwoods. However, there is no supporting documentation that this project was pursued by the Refuge. After the initial efforts made by the Refuge upon the completion of the WMP to manage the Wilderness, management developed a hands-off approach for maintaining the area. There are currently

REFUGE PURPOSES

The primary refuge purpose as defined by Public Law 80-361 mandated that the lands be administered by the Secretary of the Interior through the Fish and Wildlife Service “for the conservation of wildlife, and the development of the agricultural, recreational, industrial, and related purposes specified in this Act.”

An additional purpose was acquired when Congress designated the 4,050-acre Crab Orchard Wilderness in 1976. The establishing legislation for the Wilderness (Public Law 94-557) states that “wilderness areas designated by this Act shall be administered in accordance with the applicable provisions of the Wilderness Act...”. The purposes of the Wilderness Act (Public Law

88-577) are additional purposes of that part of the Refuge that is within the Crab Orchard Wilderness. The purposes of the Wilderness Act are to secure an enduring resource of wilderness, to protect and preserve the wilderness character of areas within the National Wilderness Preservation System (NWPS), and to administer the NWPS for the use and enjoyment of the American people in a way that will leave these areas unimpaired for future use and enjoyment as wilderness.

Wilderness Goal

Protect the ecological integrity, preserve the wilderness character, restore natural conditions to the extent practicable, and provide opportunities for solitude and primitive recreation within the Crab Orchard Wilderness.

DOCUMENTS CONSULTED

The following is a list of paper and electronic documents that I referenced to help identify and prepare measures:

Crab Orchard National Wildlife Refuge – Annual Narrative: Reports from 1978 to 1982

Retrieved from headquarters “Annual Reports” file cabinet, these documents were useful for understanding the early restoration efforts performed in the Crab Orchard Wilderness. Narratives give a brief summary on management activities in the Wilderness for each year. Only information from 1978 – 1982 was utilized due to a lack of any new activities reported in the wilderness during subsequent years.

Crab Orchard National Wildlife Refuge – Wilderness Study Summary – USDOI -- 1973

Retrieved from headquarters “Lands” file cabinet, this document is a concise review as to the suitability of the area originally proposed for designation as wilderness. The report was useful in describing the history and general description of the Crab Orchard Wilderness.

Final Environmental Statement -- Proposed Crab Orchard Wilderness Area – USDOI – December 1974

Retrieved from headquarters “Lands” file cabinet, this document offers a description of the environment associated with the Wilderness. A brief history of the area, from early European settlement to use under Refuge designation is discussed. An overall description of the natural environment is also depicted including: flora, fauna, soils, etc. This report was useful in understanding the ecological setting of the wilderness.

Crab Orchard National Wildlife Refuge – Wilderness Management Plan – April 1979

Retrieved from the Refuge storage facility located in the EMS building, this document outlines the future authorized uses, potential issues, and management goals for the Wilderness. Along

with supporting documents, the management plan helped to clarify the history of the area since its designation as wilderness.

Crab Orchard National Wildlife Refuge – Final Environmental Impact Statement and Comprehensive Conservation Plan – USDOI-FWS – July 2006

Retrieved from the Crab Orchard headquarters, this document provides a guide for the management of Crab Orchard NWR for 15 years after its publication in 2006. This document was useful in understanding the history, purpose, and goals of the Refuge. It served as a reference for nearly all fundamental functions of the refuge.

Technical Guide for Monitoring Selected Conditions Related to Wilderness Character – USDA – Landres, et. al. – June 2009

This electronic document was used as a reference in establishing the protocol for certain wilderness character measurements. It can be consulted as a manuscript for monitoring trends in wilderness character from a very general approach. The PDF file can be found at: G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

OTHER DOCUMENTS CONSULTED

Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System – USDA – July 2008

A Field Guide for the Identification of Invasive Plants in Southern Forests – USDA – July 2010

Rising to the Urgent Challenge, Strategic Plan for Responding to Accelerating Climate Change – USDOI – September, 2010

River to River Trail Guide, Fourth Edition – River to River Trail Society - 2011

Adaptive Management of Invasive Forest Plants, Project Record – USDOI – April 2012

STAFF CONSULTED

The following is a list of names and titles of the staff I collaborated with to help identify and prepare measures:

Staff	Position Titles
Doug Brewer	Refuge Manager, USFWS Crab Orchard NWR
Kevin Sloan	Deputy Refuge Manager, USFWS Crab Orchard NWR
Damon Lesmeister	Wildlife Biologist, USFWS Crab Orchard NWR
Adam Rawlinson	Law Enforcement Officer, USFWS Crab Orchard NWR
Ray Parrish	Refuge Fire Management Specialist, USFWS Crab Orchard NWR
Chuck Beasley	CERCLA
Neil Vincent	Park Ranger, USFWS Crab Orchard NWR
John Giles	Visitor Center Park Ranger, USFWS Crab Orchard NWR

PROCESS USED FOR IDENTIFYING MEASURES

Steps to identify measures:

1. Met with key refuge staff members like the Refuge Manager and gave a brief overview of the WCM project. I located important documents such as the EIS & CCP, Annual Narratives (starting from year of wilderness designation), Wilderness Management Plan, GIS files and important contacts.
2. I studied the important documents to get a better understanding of the Refuge management goals, as well as the routine operations and events at the Refuge. This helped to identify measures that were not only important to WCM, but also did not require the staff to perform extra work to collect the necessary data.
3. I met regularly with the Refuge managers, the wildlife biologist, amongst other staff to gain a collective understanding of the past and present management of the Wilderness Area. I discovered that Crab Orchard has had a mainly “hands-off” approach to wilderness management. This technique has helped to reduce the deterring signs of active management throughout the area, but lacks to monitor the effect that the surrounding land and visitor use has on the wilderness.
4. I compiled a draft of possible measures. Participated in refuge activities to get a better understanding to what is important to staff. I started with broad, complex, measures

that were given as examples for the Wilderness Fellows. These were used to facilitate discussion with the refuge staff and help generate the original list of measures for Crab Orchard.

5. I worked with the deputy refuge manager and the wildlife biologist to prioritize the list of potential measures. I took the average of their combined scores to decide the final priority level. The overall priority level of potential measures helped to decide which measures could be dropped. This helped to consolidate our list and select the measures best suited for assessing the Crab Orchard Wilderness.
6. Measures were continually altered based on data availability, clarity, and input from Refuge staff. All final measures and associated baseline data were entered into the wilderness character database.

WILDERNESS CHARACTER MONITORING

Wilderness character monitoring is based on the following five qualities interpreted from the Wilderness Protection Act of 1964:

UNTRAMMELED

Wilderness is “...an area where the earth and its community of life are untrammeled by man...” and “...generally appears to have been affected primarily by the forces of nature”

Wilderness is essentially unhindered and free from the actions of modern human control or manipulation

NATURAL

Wilderness “...is protected and managed so as to preserve its natural conditions”

Wilderness ecological systems are substantially free from the effects of modern civilization

UNDEVELOPED

Wilderness is “...an area of undeveloped Federal land...without permanent improvement or human habitation” and “...where man himself is a visitor who does not remain”

Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation

SOLITUDE OR PRIMITIVE AND UNCONFINED RECREATION

Wilderness “...has outstanding opportunities for solitude or a primitive and unconfined type of recreation”

Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation

OTHER FEATURES

Wilderness “...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.”

Wilderness preserves other tangible features that are of scientific, educational, scenic, or historical value

INDICATORS AND MEASURES

Untrammelled Quality		
<i>Wilderness is essentially unhindered and free from modern human control or manipulation.</i>		
Monitoring Question	Indicator	Measure
What are the trends in actions that control or manipulate the “earth and its community of life” inside wilderness?	Actions authorized by the Federal land manager that manipulate the biophysical environment.	1-1. Number of actions to manage fire (natural ignitions and human-caused)
		1-2. Number of actions to manipulate plants
		1-3. Number of actions to manipulate wildlife
		1-4. Number of actions to manipulate insects
		1-5. Number of actions to manipulate soil
		1-6. Number of actions to manipulate fish
		1-7. Number of actions to manipulate pathogens
		1-8. Number of actions to manipulate water
		1-9. Number of research, survey, and monitoring projects that manipulate plants, wildlife, or habitat
		1-10. Number of permitted special uses that manipulate the biophysical environment
	Actions NOT authorized by the Federal land manager that manipulate the biophysical environment.	1-11. Number of unauthorized actions taken by citizen groups, or individuals that influence the community of life inside wilderness
		1-12. Number of unauthorized , human-caused, fires
		1-13. Incidents of unauthorized horse riding

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-1): Number of actions to manage fire (natural ignitions and human-caused)

Description: A count of all authorized prescribed burns within the wilderness each year, fires that ignited from natural causes (lightning) inside wilderness that were then suppressed or manipulated by any methods of human interference.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all natural and human-caused fires are recorded by Refuge staff.

Source: The Refuge Fire Management Specialist and USFWS-FMIS (Fire Management Information Systems) website at <https://intranet.fws.gov/fmis/>

Protocol: Count all natural and human-caused (prescribed) fires that occur in the wilderness annually. Only natural fires that are suppressed within the wilderness boundary should be considered. If a fire is ignited within the wilderness and suppressed outside the boundary, it is not a fire management action. All prescribed burning within the wilderness must also be counted. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: Natural fires are infrequent occurrences in the wilderness area because it is almost an entirely closed forest of mixed hardwood and pine. There has only been one recorded wildfire in the wilderness in the last 30 years. The fire occurred in 1986 and burned approximately 26 acres of wilderness. Although infrequent as fires may be in the wilderness, the untrammeled quality is degraded when natural fire starts are suppressed. Fire is considered a critical agent of change in many wilderness ecosystems and an important community of life as referenced in Section 2(c) of the Wilderness Act. By tracking the percentage of lightning-caused fires that are suppressed, this measure shows the level of restraint in management and a willingness to allow fire to play its natural role in wilderness. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-2): Number of actions to manipulate plants

Description: A count of all authorized actions taken to manipulate vegetation including actions such as: spraying herbicide to control invasive populations, removal of invasive plants by mechanical means, spreading seed, spreading fertilizer, and planting vegetation.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of vegetation in the wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases.

The current Wilderness Goals in Crab Orchard's CCP list the restoration of native hardwood forest as an objective. This objective was planned to be completed within 15 years since its approval. The control or eradication of invasive species is another objective listed to be completed over the 15-year life of the CCP. If either of these projects is pursued, they will undoubtedly have a temporary negative impact on the untrammeled quality of the Wilderness. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-3): Number of actions to manipulate wildlife

Description: A count of all authorized actions taken to manipulate wildlife.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of wildlife in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that

it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-4): Number of actions to manipulate insects

Description: A count of all authorized actions taken to manipulate insects.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of insects in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-5): Number of actions to manipulate soil

Description: A count of all authorized actions taken to manipulate soil.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of soil in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-6): Number of actions to manipulate fish

Description: A count of all authorized actions taken to manipulate fish.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of fish in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-7): Number of actions to manipulate pathogens

Description: A count of all authorized actions taken to manipulate pathogens.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of pathogens in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammelled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammelled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-8): Number of actions to manipulate water

Description: A count of all authorized actions taken to manipulate water

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all direct management of water in the Wilderness is consistently recorded.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide

can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.

Context and relevance: This measure excludes actions related to any of the other measures under this indicator (i.e. research projects). Action refers to an intentional decision to manipulate the biophysical environment. The focus is on agency actions that represent larger scale manipulations of populations, communities, and disturbance processes rather than smaller scale, localized manipulations. The tools, equipment, structures or transportation used in association with these actions will be included under the undeveloped measurements. The untrammeled quality is degraded if the number of authorized actions that manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-9): Number of research, survey, and monitoring projects that manipulate plants, wildlife, or habitat

Description: This measure is a count of all research, survey, and monitoring projects that manipulate plants or wildlife habitat. This includes, but is not subjective to fencing, removing, or disturbing vegetation including number of actions taken to chemically immobilize, capture, remove, collar, band, and/or mark animals within the wilderness boundary.

2012 data value: 0

Significant change: Any change in this measure will be considered significant.

Data adequacy: High – all authorized research conducted on the Refuge, including research in the Wilderness Area, is known and documented.

Source: The Refuge Wildlife Biologist and/or Biological Technician

Protocol: Use professional judgment to determine which projects impact plant and wildlife habitat. The following processes can serve as a general outline in accounting for all related actions:

- Review of all special use permits relating to research, survey, and monitoring projects
- Interview Refuge staff about any internal research, survey, and monitoring projects
- Review the annual narrative

Context and relevance: Many agency and non-agency research, survey, and monitoring projects that take place on the Refuge include, but are not exclusive to the Wilderness Area. This measure is to capture a wide range of actions that happen throughout the Refuge, including the Wilderness Area, which have an impact on the biophysical environment of wilderness. Only projects, which significantly manipulate plants or wildlife habitat, will be considered. Any strictly observational project has no significant effect on the biophysical environment. This measure is relevant of the associated indicator in that it addresses a

manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-10): Number of permitted special uses that manipulate the biophysical environment

Description: This measure aims to capture the number of special use permits concerning the Wilderness. Special use permits include all specific uses of the wilderness approved by refuge management, which do not fit the general authorized uses of the Crab Orchard Wilderness. Some activities that may require a special use permit include timber removal, science projects, and trapping.

2012 data value: 0

Significant change: Any change in the number of special use permits regarding the wilderness area will be considered significant.

Data adequacy: High – all approved special use permits offer a description of the activity, location, and are consistently filed.

Source: Refuge visitor center staff files

Protocol: All special use permits are requested through an online application. Applications are viewed by refuge management before any decisions are made regarding permission for special uses of the wilderness area. During the application review process management may deny or limit certain facets of the request. Once approved, the special use permit and application is issued in hard copy to the user and an electronic document is stored on the shared drive. Once the user is finished with their permit, the hard copy is returned to the refuge and stored at visitor services. All special use permits are recorded on a yearly basis, and reported in the annual RAPP report.

All yearly special use permits assigned to the wilderness area can be requested through visitor services. Each individual permit will be counted as a permitted special use that manipulates the biophysical environment. Permits can currently be found at the following address: S:\Special Use Permits\~Special Use Permit Log and SUP Forms\Special Use Log FY12.docx.

Context and relevance: Only special uses beyond approved scientific research, survey, and monitoring projects that affect the biophysical environment will be considered for this measure. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions NOT authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-11): Number of **unauthorized** actions taken by citizen groups, or individuals that influence the community of life inside wilderness

Description: A count of all unauthorized actions taken to manipulate plants, wildlife, insects, fish, pathogens, soil or water within the wilderness.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the untrammeled quality will be degraded. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions NOT authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-12): Number of **unauthorized**, human-caused, fires

Description: This measure is a count of all unauthorized, human-caused, fires that are ignited within wilderness or ignited elsewhere and then burn into the Wilderness boundary.

2012 data value: 0

Significant change: Any change in the number of unauthorized fires will be considered significant.

Data adequacy: High – all Refuge fires are reported by the Fire Management Specialist and, in the case of arson, Law Enforcement.

Source: The lead Federal Wildlife Officer, Fire Management Specialist, and the USFWS-FMIS (Fire Management Information Systems) website at <https://intranet.fws.gov/fmis/>

Protocol: Count all unauthorized, human-caused, fires that are ignited within the wilderness or ignited elsewhere and then burn into the wilderness boundary. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality.

Context and relevance: Human-caused fires, in the case of arson, can have a large impact on the biophysical environment. The untrammeled quality is degraded if the number of unauthorized actions to manipulate the biophysical environment increases. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammeled quality of the wilderness.

Indicator: Actions NOT authorized by the Federal land manager that manipulate the biophysical environment.

Measure (1-13): Incidents of unauthorized horse riding

Description: Incidents of horse riding outside the River to River Trail. Although this measure is not directly related to mechanical transport, it mainly influences the undeveloped quality.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: Regulations controlling horseback riding on Crab Orchard NWR have seen several changes over the years. During the 1960s and up to 1979, horseback riding was permitted only in areas designated by signs or on marked horseback trails. In 1979, the regulation permitted horseback riding on existing paved or gravel roads in the public use area of the Refuge, excluding the newly designated Wilderness. However, as the result of lax law enforcement, horseback riding in the Wilderness became increasingly common. This caused an increase in the development of unauthorized trails in the Wilderness. With the approval of the CCP in 2007, horseback riding in the Wilderness became restricted to the River to River Trail and is prohibited during the months of November through May.

Unauthorized horseback riding is a concern in the Wilderness due to steep slopes and unsuitable soil. Riding outside of the River to River Trail causes erosion and degrades the undeveloped quality of the Wilderness Area. As land set aside to retain its primeval character, it is critical that wilderness is not misused by visitors. The unauthorized riding of horses inside wilderness is a severe hindrance to the preservation of wilderness character, and therefore necessitates monitoring. This measure is relevant of the associated indicator in that it addresses a manipulation in the biophysical environment, and contributes to an evaluation and understanding of the untrammelled quality of the wilderness.

Natural Quality <i>Wilderness ecological systems are substantially free from the effects of modern civilization.</i>		
Monitoring Question	Indicator	Measure
What are the trends in terrestrial, aquatic, and atmospheric natural resources inside wilderness?	Plant and animal species and communities	2-1. Presence of non-native/invasive species index
		2-2. Status of species of particular concern or interest
	Physical Resources	2-3. Air quality
		2-4. Presence of hazardous contaminants
What are the trends in terrestrial, aquatic, and atmospheric natural processes inside wilderness?	Biophysical Processes	2-5. Climate change parameters
		2-6. Change in natural fire regime
		2-7. Landscape fragmentation

Indicator: Plant and animal species and communities

Measure (2-1): Presence of non-native/invasive species index

Description: This measure is comprised of an index of the estimated percent of wilderness acreage that is occupied by non-native/invasive plant species (multiflora rose, autumn olive, black locust, and Japanese honeysuckle).

2012 data value: Of all points sampled, over half contained invasive species. The following table details the frequency of each species, the total points that contained invasives, and the amount of wilderness sampled:

Invasive Species	Percentage
Multiflora rose (<i>Rosa multiflora</i>)	72%
Autumn olive (<i>Elaeagnus umbellata</i>)	41%
Japanese honeysuckle (<i>Lonicera japonica</i>)	29%
Black locust (<i>Robinia pseudoacacia</i>)	4%
Total points containing invasives:	53%
Total Wilderness sampled:	21%

Significant change: Any increase in the percentage of invaded wilderness will be considered significant.

Data adequacy: Moderate to High – data collected has a high confidence, but only represents a sample of the Wilderness and therefore cannot accurately represent the entire Wilderness Area.

Source: The Refuge Wildlife Biologist

Protocol: Refer to the National Wildlife Refuge System *Adaptive Management of Invasive Forest Plants Project Record*. See Appendix 6: Grid-Scale Monitoring Protocol. Results from the initial monitoring effort over the summer of 2012 were calculated using Microsoft Excel. Data file can be found at: G:\BIO\GIS\Invasive Species Monitoring\InvasivePlantsProject_Wilderness_Master File.

Context and relevance: Invasive species affect 2.4 million acres of National Wildlife Refuge lands and are ecologically and economically devastating. Invasive plants affect the ability of refuges to manage for biodiversity, ecological health, and habitat for trust species in a cost-effective and publically acceptable manner. This is a particular concern for the Crab Orchard Wilderness and has a high impact on the natural quality of the area. Creating a monitoring program will help to estimate the state of invasion, prioritize management efforts within the refuge, and continued monitoring will evaluate the effectiveness of management actions. This measure is relevant to the associated indicator because it tracks the number of invasive plant communities, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Plant and animal species and communities

Measure (2-2): Status of species of particular concern or interest

Description: Number of federal and state listed threatened and endangered (T & E) species potentially found at Crab Orchard NWR.

2012 data value: 20 Endangered, 11 Threatened

Significant change: Any change in number of T & E species will be considered significant.

Data adequacy: Moderate – although the source of the data is reliable, the presence of these T & E species in the Wilderness is based on professional judgment.

Source: Crab Orchard NWR Comprehensive Conservation Plan, Refuge Wildlife Biologist

Protocol: Review the current listings of T & E species for Illinois and the surrounding states. Collaborate with the Wildlife Biologist and Refuge Management for which species have been or are likely to be found at Crab Orchard. The listing of T & E species can be found at the following address: <http://www.fws.gov/endangered/>.

State-listed Species Potentially Found at Crab Orchard NWR:

Species	Status	Breeding Status
Birds		
Pied-billed Grebe (<i>Podilymbus podiceps</i>)	Threatened	Migrant
American Bittern (<i>Botaurus lentiginosus</i>)	Endangered	Migrant; former breeder
Least Bittern (<i>Ixobrychus exilis</i>)	Threatened	Migrant; former breeder
Snowy Egret (<i>Egretta thula</i>)	Endangered	Migrant
Little Blue Heron (<i>Egretta caerulea</i>)	Endangered	Migrant
Black-crowned Night Heron (<i>Nyctanassa nycitcorax</i>)	Endangered	Migrant
Yellow-crowned Night Heron (<i>Nyctanassa violacea</i>)	Endangered	Migrant
Northern Harrier (<i>Circus cyaneus</i>)	Endangered	Migrant
Mississippi kite (<i>Ictinia mississippiensis</i>)	Endangered	Migrant
Red-shouldered Hawk (<i>Buteo lineatus</i>)	Threatened	Breeder
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Threatened	Breeder
Osprey (<i>Pandion haliaetus</i>)	Endangered	Migrant; former breeder
Peregrine Falcon (<i>Falco peregrinus</i>)	Endangered	Migrant
Common Moorhen (<i>Gallinula chloropus</i>)	Threatened	Migrant
Sandhill Crane (<i>Grus Canadensis</i>)	Threatened	Migrant
Upland Sandpiper (<i>Bartramia longicauda</i>)	Endangered	Migrant; former breeder
Wilson's Phalarope (<i>Phalaropus tricolor</i>)	Endangered	Migrant
Forster's Tern (<i>Sterna forsteri</i>)	Endangered	Migrant
Least Tern (<i>Sterna antillarum</i>)	Endangered	Migrant
Black Tern (<i>Chlidonias niger</i>)	Endangered	Migrant
Barn Owl (<i>Tyto alba</i>)	Endangered	Migrant
Short-eared Owl (<i>Asio flammeus</i>)	Endangered	Migrant
Loggerhead Shrike (<i>Lanius ludovicianus</i>)	Threatened	Breeder
Brown Creeper (<i>Certhia americana</i>)	Threatened	Migrant
Bewick's Wren (<i>Thryomanes bewickii</i>)	Endangered	Migrant
Henslow's Sparrow (<i>Ammodramus henslowii</i>)	Endangered	Breeder
Mammals		
Indiana bat (<i>Myotis sodalis</i>)	Endangered	Status Unknown
Golden mouse (<i>Ochrotomys nuttalli</i>)	Threatened	Breeder
Marsh rice rat (<i>Oryzomys palustris</i>)	Threatened	Breeder
River otter (<i>Lontra canadensis</i>)	Threatened	Status Unknown
Plants		
Hairy synandra (<i>Synandra hispidula</i>)	Endangered	

Context and relevance: The Wilderness may offer suitable habitat, temporary shelter or feeding grounds for T & E species. A variation in the number of T & E species could certainly be caused by actions not under the control of the wilderness manager. Nonetheless, an increase in the number of T & E species in the Wilderness will be considered an improvement in the natural quality. If the species number decreases, it will indicate a degrading trend in the wilderness character, unless the species is delisted and no longer considered threatened or endangered. This measure is relevant to the associated indicator because it tracks the number of sensitive wildlife and plant species, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Physical resources

Measure (2-3): Air Quality

Description: Air quality is measured using four unique indicators for the Crab Orchard Wilderness Area: Ozone (ppb), Total-Nitrogen deposition (kg/ha), Total Sulfur deposition (kg/ha), and Visibility (dv).

2012 data value: The baseline value is based on the 5-year averages for the years 2005-2009 and is the most recent years for which the Branch of Air Quality has complete datasets for all values. The following table lists each air quality indicator, its corresponding value, and the associated condition:

Air quality metric	2009 value	Condition
Ozone air pollution	73.6 ppb	Moderate
Total nitrogen wet deposition	5.3 kg/ha	Significant Concern
Total sulfur wet deposition	5.9 kg/ha	Significant Concern
Visibility	13.2 dv	Significant Concern

Significant change: Any increase or decrease resulting in a change in the “condition” of the data value according to the scoring range will be considered significant.

Data adequacy: Moderate – For wilderness areas where the FWS NWRS Branch of Air Quality does not have air quality monitors in close proximity, data values may have been interpolated between monitors. Interpolated data have the assigned confidence level of moderate (or, as described in the database, “medium”), and, as per the protocol dictated by the Branch of Air Quality, will not be used to assess a trend.

Source: FWS NWRS Branch of Air Quality

Protocol: All data required will be provided by the FWS NWRS Branch of Air Quality. Data values reported represent the 5-year averages for each metric. Condition of the air quality related value is based on the following parameters:

Ozone:
< 60 ppb - Good
61-75 - Moderate
> 76 - Significant Concern

Visibility:
< 2 dV - Good
2-8 - Moderate
> 8 - Significant Concern

Total-N and S:
<1 kg/ha - Good
1-3 - Moderate
> 3 - Significant Concern

Context and relevance: Air quality, while largely beyond the control of refuge management, is an important and constant aspect of wilderness character. This measure is relevant of the associated indicator in that it addresses effects on a physical resource, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Physical resources

Measure (2-4): Presence of hazardous contaminants

Description: This measure gauges the number of different contaminants found within soil, water, and watershed.

2012 data value: 0

Significant change: Any change in the presence and amount of contaminants will be considered significant.

Data adequacy: High – if contaminants are found in the Wilderness there is likely to be an extensive monitoring effort.

Source: CERCLA files

Protocol: Confirm with Environmental Contaminants staff if there are any hazardous contaminants found in the Wilderness boundary. This may require some professional judgment if no formal survey is implement inside the wilderness, but contaminants are found on surrounding lands and water bodies. Count each type contaminant for monitoring purposes.

Context and relevance: This measure is included because of the ever-prevalent history of contamination on the Refuge. The Refuge is currently on the U.S. Environmental Protection Agency's National Priority List of hazardous waste sites. The Fish and Wildlife Service's Ecological Services branch has an Environmental Contaminants staff co-located at the Refuge who manage the investigation, monitoring, and remediation of hazardous contamination sites on the Refuge. Although the Wilderness Area is not recognized as a hazardous waste site for the dangerous contaminants found elsewhere on the Refuge, it is still a critical monitoring feature. If contaminants are found in the Wilderness, the natural quality will be degraded. This measure is relevant of the associated indicator in that it addresses effects on a physical resource, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Biophysical Processes

Measure (2-5): Climate change parameters

Description: A suite of three weather data measures is used to gather information on climate change influences at a local level. Each measure utilizes data recorded by the RAWs, located on Crab Orchard NWR.

2012 data value: The baseline value is based on seasonal averages and compiled totals. The following table illustrates the chosen parameters and associated values:

Climate change metric	2012 value
Mean summer temperature	78.93 °F
Mean winter temperature	40.30 °F
Total winter precipitation	7.47 inches

Significant change: A ten-year trend must be created to determine significant change, this will account for abnormal yearly fluctuations.

Data adequacy: High-all data is collected on the Refuge in a location near the Wilderness Area.

Source: Crab Orchard's Remote Automated Weather Station (RAWs) data found at: http://raws.wrh.noaa.gov/cgi-bin/roman/meso_base.cgi?stn=COWI2.

Protocol: Using Microsoft Excel, analyze weather data for the following records: mean summer temperature, mean winter temperature, and total winter precipitation. Summer is defined as the months of June, July, and August. Winter is defined as the months of December, January, and February. Mean summer and winter temperatures should be calculated for each year. These seasonal means are then averaged over a five-year time interval. Since the year changes in the middle of the winter season, mean winter temperatures for any given year are calculated using data from December of the previous year and data from January and February of the target year. Total precipitation is calculated for the winter months and then these seasonal totals are averaged over a five-year time interval.

Context and relevance: A growing body of evidence has linked accelerating climate change with observed changes in fish and wildlife, their populations, and their habitats in the United States. Climate change has the potential to cause abrupt ecosystem changes and increased species extinctions. The same ecosystem functions that provide for sustainable fish and wildlife populations also provide communities with significant benefits such as good water quality, flood and fire protection, and recreation. The fact that climate change affects us on a global scale poses obvious problems to wilderness as well.

Attempting to monitor climate change and its widespread effects on wildlife is a national priority for many organizations, but there is no set protocol for how to do this in a cohesive manner. While the weather data measures described here are admittedly simplified proxies for

representing climate change, they are an efficient means for Refuge staff to gather data directly linked to climate change and weather patterns. In general, the natural quality would be degraded if mean summer or winter temperatures increase, or if winter precipitation decreases. This measure is relevant of the associated indicator in that it addresses effects on biophysical processes, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Biophysical Processes

Measure (2-6): Change in natural fire regime

Description: This measure assesses alterations in the natural fire regime of the Wilderness Area from pre-European settlement.

2012 data value: 3 = "Fire regimes have been significantly altered from their historical range."

Significant change: Any change in the natural fire regime will be considered significant

Data adequacy: Moderate – this data is subjective as it is based on professional judgment.

Source: The Refuge Fire Management Specialist

Protocol: Refer to *The Guide to Using FMIS*. The Fire Management Specialist or the next most qualified person available should be consulted when selecting regime conditions. The regime conditions will only be altered if a fire has occurred in the Wilderness.

Based on the following guidelines, select pre-condition and post-condition values to determine the current relation to the appropriate fire frequency:

Regime Classes: Select a value from 1 to 5:

1. Frequency: 0-35; Vegetative type: Long needle pine (ex. Ponderosa Pine)
2. Frequency: 0-35; Vegetative type: drier grasslands; tall grass
3. Frequency: 36-100; Vegetative type: interior dry site shrub communities
4. Frequency 35-100; Vegetative type: short needle pine (ex. Jack Pine)
5. Frequency >100; Vegetative type: tropical rainforest

* Because official vegetative type does not capture the Crab Orchard Wilderness vegetative type, refer to Anderson, H.E (1982) - *Fire Behavior Fuel Models 8 & 9*

Pre-Condition Class: Select value from 1 to 3:

1. "Fire regimes are within historical ranges."
2. "Fire regimes have been moderately altered from their historical return interval."
3. "Fire regimes have been significantly altered from their historical range."

Post-Condition Class: Select a value from 1 to 3:

1. "Fire regimes are within historical ranges."

2. "Fire regimes have been moderately altered from their historical return interval."
3. "Fire regimes have been significantly altered from their historical range."

Context and relevance: Based on historical fire data, pre-European settlement, and species specific fire adaptability the Wilderness Area is a Fire Regime Class 1. Fire frequency is not at its natural occurrence, Class 1, due to the current Refuge Fire Management Plan. Natural fire ignitions and prescribed burning may help to return the Wilderness to its historic fire frequency. In the event of a fire in the Wilderness, the fire regime condition may be changed to a lower value on the scale of 1 to 3. A lower value will indicate an improving trend in the wilderness character. This measure is relevant of the associated indicator in that it addresses effects on biophysical processes, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Indicator: Biophysical Processes

Measure (2-7): Landscape fragmentation

Description: This measure is used to calculate the linear distance of wilderness boundary contiguous with Refuge boundary where adjacent land is managed by an entity other than the Fish and Wildlife Service or is managed for purposes other than wilderness. The measure does not include land inside the Refuge that is deemed non-wilderness, the USDA Forest Service Wilderness (Panther's Den), nor the miles of shoreline that form Little Grassy and Devils Kitchen Lakes.

2012 data value: 8.1 miles

Significant change: Any increase in miles of adjacent land inconsistent with the wilderness management goals of the Crab Orchard Refuge will be considered significant.

Data adequacy: Moderate – this data is subjective since it is based on professional judgment.

Source: Refuge GIS data

Protocol: Utilizing spatial analysis tools such as GIS, measure the linear distance of wilderness boundary adjacent to land that is managed by an entity other than the Fish and Wildlife Service or for purposes inconsistent with wilderness goals. This requires a level of professional judgment and knowledge of the current land practices implemented by private landowners adjoining the Wilderness.

Context and relevance: Landscape fragmentation poses many threats to the wilderness area, particularly when adjacent land is managed inconsistently with the goals of maintaining the wilderness character. Much of the property bordering the Crab Orchard Wilderness is Refuge owned and some is operated by the U.S. Forest Service. This property acts as a buffer from nearby lands, which may alter the natural quality of the Wilderness. A decrease in land bordering the Wilderness that is inconsistent with wilderness goals will indicate an improving trend in the wilderness character. This measure is relevant of the associated indicator in that it addresses effects on biophysical processes, and contributes to an evaluation and understanding of the natural quality of the wilderness.

Undeveloped Quality <i>Wilderness retains its primeval character and influence, and is essentially without permanent improvement or modern human occupation.</i>		
Monitoring Question	Indicator	Measure
What are the trends in non-recreational development and mechanization inside wilderness?	Non-recreational installations, structures, developments	3-1. Miles of road dividing the wilderness
	Inholdings	3-2. Acres of inholdings within the wilderness
What are the trends in mechanization inside wilderness?	Use of motorized vehicles, motorized equipment, or mechanical transport	3-3. Number of actions requiring a minimum tool analysis
		3-4. Authorized emergency uses
		3-5. Incidents of ATV use in the wilderness
		3-6. Miscellaneous unauthorized uses

Indicator: Non-recreational structures, installations, developments

Measure (3-1): Miles of road dividing the wilderness

Description: This measure quantifies the total length (in miles) of Rocky Comfort Road that bisects the Crab Orchard Wilderness.

2012 data value: 1.29 miles

Significant change: Any decreased in miles of road will be considered significant.

Data adequacy: Data adequacy is high because all roadways within the Refuge are available in the Refuge GIS data files.

Source: Refuge GIS data files

Protocol: Personal observation or review of the Refuge GIS files.

Context and relevance: Rocky Comfort Road currently dissects the wilderness into two units – Little Grassy on the west side and Devils Kitchen on the east, which borders the road for a distance of a little over a mile. The presence of this road affects the wilderness in a number of ways including easier access for the public, potential pathway for invasive species, and potential for noise pollution. Although it is technically outside the wilderness boundaries, the road still has a significant impact of the character of this wilderness. Wilderness is a place where “the imprint of man’s work [is] substantially unnoticeable.” Although there are no plans to decommission Rocky Comfort Road in the near future, its removal could improve the undeveloped quality. This measure is relevant to the associated indicator in that it addresses

the presence of non-recreational structures, installations, and developments, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Inholdings

Measure (3-2): Acres of inholdings

Description: An inholding is any non-federal land within the wilderness boundary. It does not include cherry-stemmed parcels (Rocky Comfort Road) or external edge-holdings that may be acquired in the future. This measure accounts for the total acreage of inholdings within the Wilderness boundary.

2012 data value: 0

Significant change: Any change will be considered significant.

Data adequacy: High – the existence of private or public inholdings within the Wilderness will be well documented if altered.

Source: Refuge management

Protocol: Review of the CCP shows the history of the two parcels within the Wilderness that do not hold wilderness designation and their current ownership by the Refuge. Discussions with refuge management regarding these parcels will be sufficient in determining their status in future data collection.

Context and relevance: There are currently no private or public inholdings within the Crab Orchard Wilderness. The parcels owned by the Fish and Wildlife Service within the boundary that are not wilderness is not to be included in this measure as an inholding. A change in the acreage of inholdings is highly unlikely to change given that the entire wilderness is under the control of the federal government and protected under the Wilderness Act of 1964. This measure has low significance to this particular wilderness and has been included only in order to represent this indicator within the wilderness character monitoring framework. This measure is relevant to the associated indicator in that it addresses the presence of Inholdings and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Use of motorized vehicles, motorized equipment, or mechanical transport

Measure (3-3): Number of actions requiring a minimum tool analysis

Description: This measure sums the number of actions requiring a minimum tool analysis. This includes all authorized motor vehicle, motorized equipment, wildlife survey, and mechanical transport uses in or over wilderness.

2012 data value: 0

Significant change: Any change will be considered significant.

Data adequacy: High – all actions that require a minimum tool analysis are recorded with detailed description of the associated activity and location.

Source: Refuge data files – minimum tool analysis

Protocol: Use professional judgment to determine the minimum tool analyses that are unrelated to emergency uses. The following processes can serve as a general outline in accounting for all related actions:

- Review of all minimum tool analyses conducted over the past fiscal year
- Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*, to determine what is counted as one action or many.
- Total all actions requiring a minimum tool analysis

Context and relevance: The minimum tool analysis is designed to assist wilderness managers in making appropriate decisions in wilderness. By implementing a minimum tool analysis, managers can ideally selected the least intrusive option for accomplishing a given task and thus maintain the wilderness character. This measure is relevant to the associated indicator in that it accounts for authorized use of motorized vehicles, motorized equipment, or mechanical transport that occurs in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Use of motorized vehicles, motorized equipment, or mechanical transport

Measure (3-4): Authorized emergency uses

Description: A count of all authorized emergency actions that occur within the wilderness boundary.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: In the event of an emergency, a minimum tool analysis can become an unnecessary obstacle for management to react quickly and efficiently. This measure aims to account for all usage of motorized vehicles, motorized equipment, or mechanical transport employed in such events. Although, necessary as these actions may be during emergencies, the use of such machinery still detracts from the undeveloped quality of the Wilderness. This measure is relevant to the associated indicator in that it accounts for all authorized use of motorized vehicles, motorized equipment, or mechanical transport that occurs in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of

the wilderness.

Indicator: Use of motorized vehicles, motorized equipment, or mechanical transport

Measure (3-5): Incidents of ATV use in the wilderness

Description: The unauthorized use of all-terrain vehicles within the Wilderness boundary.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: There are currently a few two-track trails entering sections of the Wilderness from adjacent private and public lands. Law enforcement confirmed that citations have been issued in the past for unauthorized use of ATV’s in the Wilderness during hunting season. Measuring the length of these trails in the Wilderness could be useful for monitoring the undeveloped quality; however, varying levels of prominence and current usage are difficult to determine. Incidents of unauthorized ATV use in the Wilderness are instead used to monitor this issue. The unauthorized use of vehicles inside wilderness is a severe hindrance to the preservation of wilderness character, and therefore necessitates monitoring.

This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the undeveloped quality will be degraded. This measure is relevant to the associated indicator in that it accounts for the unauthorized use of motorized vehicles, motorized equipment, or mechanical transport that occurs in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Use of motorized vehicles, motorized equipment, or mechanical transport

Measure (3-6): Miscellaneous unauthorized uses

Description: All unauthorized uses of the wilderness area that do not fall under measure 3-3 or 3-4. Examples include marijuana fields, illegal wood harvest, etc...

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the undeveloped quality will be degraded. This measure is relevant to the associated indicator in that it accounts for the unauthorized use of motorized vehicles, motorized equipment, or mechanical transport that occurs in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Solitude or Primitive and Unconfined Recreation Quality <i>Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation.</i>		
Monitoring Question	Indicator	Measure
What are the trends in outstanding opportunities for solitude inside wilderness?	Remoteness from sights and sounds of people inside the wilderness	4-1. Visitors to wilderness areas
		4-2. Percent of wilderness away from access or travel routes
	Remoteness from occupied and modified areas outside of the wilderness	4-3. Travel routes adjacent to wilderness
What are the trends in outstanding opportunities for primitive and unconfined recreation inside wilderness?	Facilities that decrease self-reliant recreation	4-4. Miles of authorized trail in the wilderness
		4-5. User-created recreation facilities
	Management restrictions on visitor behavior	4-6. Management restrictions

Indicator: Remoteness from sights and sounds of people inside the wilderness

Measure (4-1): Visitors to wilderness area

Description: The estimated total visitors to the Wilderness Area each year based on people who enter at the popular River to River Trailheads.

2012 data value: Data value is pending upon Park Rangers input.

Significant change: A yearly increase of 5 % in visitor use will be considered significant.

Data adequacy: Moderate – although trail counters offer an idea of visitors entering the Wilderness via popular the River to River trail, visitors are essentially free to enter anywhere along the Wilderness boundary.

Source: Visitor Services

Protocol: There are currently two infrared trail traffic counters installed to monitor visitors use in the wilderness area. The counters are located on the wilderness boundary at common access points. One counter is on the River to River Trail crossing at Rocky Comfort Road and the other is at the River to River Trail Head on Line 9. The counters are maintained and monitored by park rangers.

The visitor services staff utilizes a software program for interpreting data collected by the trail counters. Visitor use is broken down by number of monthly, weekly, and daily visitors along with average visitors per day. This measure only considers total visitors per year.

Context and relevance: Although two traffic counters can only account for visitors entering the Wilderness via the River to River Trail, this is the most feasible and consistent method for monitoring amount of visitor use. The solitude or primitive and unconfined recreation quality would be degraded if there were an increase in annual visitors. This measure is relevant to the associated indicator because it relates to the remoteness from sights and sounds of people inside the wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Remoteness from sights and sounds of people inside the wilderness

Measure (4-2): Percent of wilderness away from access or travel routes

Description: The percentage of wilderness within a certain buffer distance from roads, trails, or waterways, either inside or adjacent to the wilderness.

2012 data value: 57.85%

Significant change: A 5% change in this percentage will be considered significant.

Data adequacy: Medium – unauthorized foot trails were not considered into the measure due to insufficient data.

Source: Refuge GIS files

Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the percentage of wilderness away from access or travel routes. Utilizing ArcGIS, an analyst must perform the following task in order to calculate the percentage of wilderness away from access or travel routes:

1. Acquire GIS layers for all travel routes – one for trails, one for roads, and shoreline accessible to the wilderness.
2. Create a buffer of appropriate size around each travel route.
3. Subtract the buffers from the wilderness polygon using the erase tool.
4. Calculate the area of remaining wilderness after all the travel route buffers have been erased.

The following distances away from access and travel routes were subjectively chosen for the Crab Orchard Wilderness:

- Active recreation trails and gas motor-prohibited waterways inside or adjacent to wilderness – 100 m
- Lake shore allowing wilderness access by motor boat – 200m
- Open automobile roads – 300 m

Refer to the guidelines set forth on pages 188-191 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character* for further information. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring. Baseline GIS analysis can be found at: G:\BIO\Wilderness Character Monitoring\Crab Orchard NWR\GIS\WCM_Travel_Routes.mxd

Context and relevance: The effective distance from selected travel routes and access points for gaining a feeling of remoteness from sights and sounds within the wilderness was determined through personal observation. Travel routes and access points were given a slightly larger buffer than needed because observations were conducted during the summer months when vegetation density was at its peak. Only the River to River Trail was counted as a recreation trail because it is the only trail officially recognized by the Fish and Wildlife Service and therefore acts as a consistent measurement.

The shorelines of Devils Kitchen and Little Grassy Lakes, Devils Kitchen Road, and Rocky Comfort Road are not technically included in the wilderness boundary. These access/travel routes were included simply because they protrude into the wilderness area, which has a significant impact on the experience of solitude. This measure estimates the amount of land inside the wilderness where visitors can gain a feeling of solitude. It is relevant to the associated indicator because it relates to the remoteness from sights and sounds of people inside the wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Remoteness from occupied and modified areas outside of the wilderness

Measure (4-3): Travel routes adjacent to wilderness

Description: This is a measure of the miles of active roads and open shoreline adjacent to the Wilderness boundary.

2012 data value: 20.5 miles

Significant change: Any change in the miles of routes adjacent to the Wilderness will be considered significant.

Data adequacy: High

Source: Refuge GIS files

Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the mileage of roads and shorelines adjacent to the Wilderness. The following data is the individual values for shoreline and road mileage obtained by analysis using ArcGIS for the 2012 baseline value:

Roads total: 3.5 mi

Shoreline total: 17mi

Context and relevance: The Crab Orchard Wilderness currently has a number of small roads, developments, and two public lakes surrounding it. This measure aims to capture the influence that adjacent travel has on a visitor's experience. An increase in the mileage of active roads and shoreline bordering the Wilderness Area will indicate a degrading trend in the wilderness

character. This measure is relevant to the associated indicator because it relates to the remoteness from occupied and modified areas outside the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Facilities that decrease self-reliant recreation

Measure (4-4): Miles of authorized trail in the wilderness

Description: Miles of the official River to River trail route located within the Wilderness boundary.

2012 data value: 2.5 miles

Significant change: Any change in the length of the official trail route on within the Wilderness boundary will be considered significant.

Data adequacy: Moderate-High. Although the official length that is used for the 2012 baseline assessment,

Source: Refuge GIS files and Visitor Center Park Rangers

Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the miles of authorized trail in the wilderness. Utilizing ArcGIS, an analyst must perform the following tasks in order to calculate distance:

1. Acquire GIS layers for all official trails.
2. Separate the trail within the Wilderness boundary using the clip tool.
3. Use the measure tool to determine total length.

If any new trail or alteration to the existing trail is authorized by the Refuge Manager, a new shapefile of the route may need to be created using a GPS.

Context and relevance: The River to River trail is the only hiking and equestrian used trail located in the Wilderness that is officially recognized by the Crab Orchard Refuge. The trail was rerouted from its previous course in 2010 after the approval of the CCP to shorten its distance within the Wilderness Area. Before its new route, the River to River Trail was never technically authorized by the Refuge. However, due to lax law enforcement it remained a maintained, popular course for hikers and horse riders. Volunteers keep the trail clear of debris, using primitive tools when necessary, and small diamond shaped plastic signs are used to mark its route. An increase in the length of the River to River trail or any additional trails authorized by the Refuge within the boundary of the Wilderness will indicate a degrading trend in the wilderness character. This measure is relevant to the associated indicator because accounts for a development that decreases self-reliant recreation in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Facilities that decrease self-reliant recreation

Measure (4-5): User-created recreation facilities

Description: Number of unauthorized user-created recreation facilities (Permanent deer stands, camps, etc.).

2012 data value: 2 (this is from my personal observations), **Data value is pending upon LE officers input.**

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Personal observation, lead Federal Wildlife Officer, and law enforcement database

Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the undeveloped quality will be degraded. This measure is relevant to the associated indicator because accounts for unauthorized facilities that decrease self-reliant recreation in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Management restrictions on visitor behavior

Measure (4-6): Management restrictions

Description: This measure is a count of the current visitor behavior restrictions.

2012 data value: 7

Significant change: Any additional restrictions, change in current restrictions, or removal of restrictions will be considered significant.

Data adequacy: Medium – the number of restrictions count was based on professional judgment of what constitutes a restriction.

Source: CCP and Wilderness Management Plan

Protocol: This measure is a simple count of the management restrictions set-forth for the Crab Orchard Wilderness. Discussion with the Refuge Managers should be sufficient in determining any changes in management restrictions.

Management restrictions currently include:

- Camping
- Recreational and technical rock climbing
- Trapping
- Horseback Riding outside of designated River to River Trail and from the months of November through May.
- Camp fires
- Wildlife disturbance
- Collecting particular flora

Context and relevance: Based on the Wilderness Act of 1964, and reinforced through the operational definitions proposed by this monitoring program, outlets for primitive and unconfined recreation represent a major contributing quality to the overall character of wilderness. Management of wilderness includes the creation and enforcement of visitor use/behavior restrictions, which ultimately affect the quality of a visitor's recreational experience. To protect the unique qualities of the Crab Orchard Wilderness, fragile soil and distinctive sandstone crags for example, additional visitor use restrictions have been implemented. Due to the already limited allowable activities in the wilderness, management is unlikely to create any additional restrictions. If there is an increase in visitor restrictions necessitated by an unsustainable increase in visitor activity, the solitude and unconfined recreation quality will be degraded. This measure is relevant to the associated indicator because it accounts for management restrictions that deduct from a feeling of unconfined recreation, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Other Features Quality		
<i>Wilderness "...may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."</i>		
Monitoring Question	Indicator	Measure
What are the trends in loss of geological and cultural resources?	Loss of paleontological or geological resources	5-1. Number of unauthorized removals of paleontological or geological resources
	Loss of statutorily protected cultural resources	5-2. Number of unauthorized removals of cultural resources

Indicator: Loss of paleontological or geological resources

Measure (5-1): Number of unauthorized removals of paleontological or geological resources

Description: This measure is a count of all unauthorized removals of paleontological or geological resources.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related to Wilderness Character*. See Table 11 for general rules for counting and reporting number of actions. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the undeveloped quality will be degraded. This measure is relevant to the associated indicator because accounts for loss of paleontological or geological resources in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

Indicator: Loss of statutorily protected cultural resources

Measure (5-2): Number of unauthorized removals of cultural resources

Description: This measure is a count of all unauthorized removals of cultural resources.

2012 data value: Data value is pending upon LE officers input.

Significant change: Any change in this measure will be considered significant

Data adequacy: The data adequacy will fluctuate depending on law enforcement efforts to monitor unauthorized activity in the wilderness.

Source: Lead Federal Wildlife Officer and law enforcement database

Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service *Technical Guide for Monitoring Select Conditions Related*

to Wilderness Character. See Table 11 for general rules for counting and reporting number of actions. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.

Context and relevance: This measure is likely to vary from year to year depending on refuge resources. Limited law enforcement resources are a current constraint on the amount of patrolling that takes place in and around the wilderness. The presence of law enforcement also changes during the different seasons. In order to gain a more accurate assessment of these unauthorized actions taking place in the wilderness, the measure will be conducted on a five-year frequency. This will help to account for the fluctuation in law enforcement efforts in the wilderness. If the total number of unauthorized actions taking place in the wilderness increases, the undeveloped quality will be degraded. This measure is relevant to the associated indicator because accounts for the loss of statutorily protected cultural resources in the Wilderness, and contributes to an evaluation and understanding of the undeveloped quality of the wilderness.

DROPPED MEASURES

The following measures were considered for inclusion as in the monitoring suite, but were later deemed unfeasible, lacking in significant data, inefficient, or otherwise unfit as measures of wilderness character at Crab Orchard NWR:

Dropped Measures	Reasons why measure was dropped					
	Data not available/ quality of available data poor	Insufficient development of measure	Low relevance to this wilderness	Not feasible for Refuge to monitor	Notes	Priority
Population dynamics of selected native species	X	X		X	This measure was decidedly too complex for consistent monitoring.	Medium
Status of habitat for selected species	X	X		X		Medium

Extirpated native species			X			Low
Water quality and quantity	X		X	X		Medium
Watershed function	X	X		X		Low
Pathways for invasives	X	X		X	Although this is a high priority to the Refuge, there is no feasible way to monitor pathways quantitatively due to a lack of sufficient data.	High
Index of unauthorized physical structures, installations, or developments	X	X				Medium
Index of abandoned structures	X		X			Low
Authorized administrative uses	X		X			Medium
Viewshed	X		X		Not an issue, the wilderness is heavily wooded and mainly surrounded by refuge land and water.	Low

Soundscape	X	X		X	Although the wilderness is more vulnerable to noise pollution when the trees are bare, we did not develop a protocol to measure this change effectively.	Low
Night sky light pollution	X	X	X		Not an issue, light pollution from nearest cities is at a minimum.	Low

CONCLUSION

The suite of measures adequately represents the wilderness character of the Crab Orchard NWR Wilderness. A total of 34 measures are incorporated into the monitoring protocol (Untrammelled quality = 13, Natural quality = 7, Undeveloped quality = 6, Opportunities for Solitude or Primitive and Unconfined Recreation quality = 6, and Other Features quality = 2). This list was created in anticipation that it will be feasible for Refuge staff to monitor over time. Most measures were designed to satisfy the indicators by assessing broad trends in wilderness. Complex monitoring protocols were disregarded or altered due to wilderness management efforts currently being a low priority for Refuge management. There are opportunities to incorporate other measures through relatively easy means if new monitoring projects are established that include wilderness.

During the creation of this report, the largest threat to the character of the Crab Orchard Wilderness is the rapid invasion of exotic plant species. This hazard to plant biodiversity poses the serious risk of a permanent alteration to the natural quality of the wilderness character. Of course, this issue is not exclusive to the Wilderness Area, but a problem in forested areas Refuge wide. After discussions with Refuge staff, it was determined this will take precedence in wilderness character monitoring for the immediate future. During the summer of 2012 an invasive species inventory was conducted following the guidelines of a draft protocol being designed for use in the National Wildlife Refuge System. If adopted, this protocol will consistently track the abundance of invasive species in the Wilderness Area.

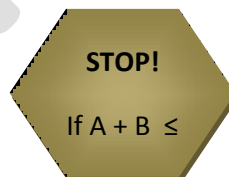
Many of the measures selected will likely reflect a stable trend from year to year unless a significant event takes place in wilderness. Until staff at the Crab Orchard Refuge increases, it is likely that the Wilderness Area will continue to receive little attention concerning management efforts. The implementation of wilderness character monitoring will offer insight into the condition of the Wilderness, and aid in necessary management decisions as they arise.

APPENDIX A: PRIORITY RANKING OF MEASURES

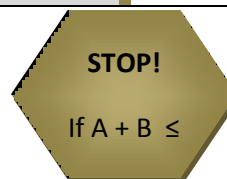
UNTRAMMELED QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manage fire (natural ignitions and human-caused)	3	2	3	1	9	High
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate plants	3	2	3	1	9	High
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate wildlife	3	3	2	1	9	High
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate insects	3	2	2	1	8	Medium
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment.	2	1	3	1	7	Medium

UNTRAMMELED QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Measure:</u> Number of actions to manipulate soil						
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate fish	1	1	3	1	6	Medium
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate pathogens	2	2	2	1	7	Medium
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of actions to manipulate water	1	1	3	1	6	Medium
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of research, survey, and monitoring projects that manipulate plants or wildlife habitat	3	2	3	1	9	High
<u>Indicator:</u> Actions authorized by the Federal land manager that manipulate the biophysical environment.	2	2	3	1	7	Medium

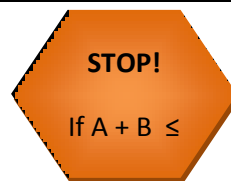
UNTRAMMELED QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Measure:</u> Number of permitted special uses that manipulate the biophysical environment						
<u>Indicator:</u> Actions NOT authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of unauthorized actions taken by citizen groups, or individuals that influence the community of life inside wilderness	3	2	1	1	7	Medium
<u>Indicator:</u> Actions NOT authorized by the Federal land manager that manipulate the biophysical environment. <u>Measure:</u> Number of unauthorized , human-caused, fires	3	2	2	1	8	Medium
<u>Indicator:</u> Use of motorized vehicles, motorized equipment, or mechanical transport. <u>Measure:</u> Incidents of unauthorized horse riding outside the River to River Trail	3	2	1	1	7	Medium



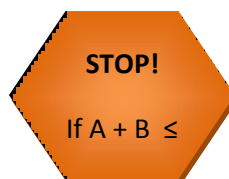
NATURAL QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Indicator:</u> Plant and animal species and communities <u>Measure:</u> Presence of non-native/invasive species index	3	3	3	0	9	High
<u>Indicator:</u> Plant and animal species and communities <u>Measure:</u> Status of species of particular concern or interest	2	2	2	1	8	Medium
<u>Indicator:</u> Physical resources <u>Measure:</u> Air quality	2	1	1	1	5	Medium
<u>Indicator:</u> Physical resources <u>Measure:</u> Presence and amount of contaminants	2	2	1	1	6	Medium
<u>Indicator:</u> Biophysical processes <u>Measure:</u> Climate change parameters	3	3	1	1	8	Medium
<u>Indicator:</u> Biophysical processes <u>Measure:</u> Change in natural fire regime	3	2	2	1	8	Medium
<u>Indicator:</u> Biophysical processes <u>Measure:</u> Pathways for invasives	3	3	2	1	9	High
<u>Indicator:</u> Biophysical processes <u>Measure:</u> Landscape fragmentation	3	2	1	1	7	Medium



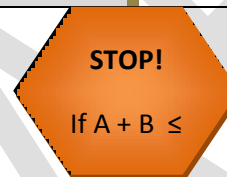
UNDEVELOPED QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Indicator:</u> Non-recreational structures, installations, developments <u>Measure:</u> Miles of road dividing the wilderness	1	1	3	1	6	Medium
<u>Indicator:</u> Use of motorized vehicles, motorized equipment, or mechanical transport. <u>Measure:</u> Number of actions requiring a minimum tool analysis	2	1	3	1	7	Medium
<u>Indicator:</u> Use of motorized vehicles, motorized equipment, or mechanical transport. <u>Measure:</u> Authorized emergency uses	2	1	2	1	6	Medium
<u>Indicator:</u> Use of motorized vehicles, motorized equipment, or mechanical transport. <u>Measure:</u> Incidents of unauthorized ATV use in the wilderness	3	2	1	1	7	Medium
<u>Indicator:</u> Use of motorized vehicles, motorized equipment, or mechanical transport. <u>Measure:</u> Miscellaneous unauthorized uses	3	2	1	1	7	Medium



SOLITUDE OR PRIMITIVE AND UNCONFINED QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Indicator:</u> Remoteness from sights and sounds of people inside the wilderness <u>Measure:</u> Visitors to wilderness areas	2	2	2	1	7	Medium
<u>Indicator:</u> Remoteness from sights and sounds of people inside the wilderness <u>Measure:</u> Percent of wilderness away from access or travel routes	2	2	2	1	7	Medium
<u>Indicator:</u> Remoteness from occupied and modified areas outside of the wilderness <u>Measure:</u> Travel routes adjacent to wilderness	2	2	2	1	7	Medium
<u>Indicator:</u> Facilities that decrease self-reliant recreation <u>Measure:</u> Miles of authorized trail in wilderness	2	2	3	1	8	Medium
<u>Indicator:</u> Facilities that decrease self-reliant recreation <u>Measure:</u> User-created recreation facilities	3	2	2	1	8	Medium
<u>Indicator:</u> Management restrictions on visitor behavior <u>Measure:</u> Management restrictions	3	2	3	1	9	High



OTHER QUALITY: Criteria for Prioritizing Potential Measures						PRIORITY LEVEL
Potential Measure	A. Importance	B. Vulnerability	C. Reliability	D. Reasonableness	OVERALL SCORE	
<u>Indicator:</u> Loss of paleontological or geological resources <u>Measure:</u> Number of unauthorized removals of paleontological or geological resources	2	2	1	1	6	Medium
<u>Indicator:</u> Loss of statutorily protected cultural resources <u>Measure:</u> Number of unauthorized removals of cultural resources	2	2	1	1	6	Medium



APPENDIX B: SUMMARY OF EFFORT FOR WILDERNESS CHARACTER MONITORING

Quality	Indicator	Measure	Estimated time required to gather and interpret data (1 = minimal, 2 = moderate, 3 = high)	Comments
Untrammeled	Authorized actions	1-1. Number of actions to manage fire (natural ignitions and human-caused)	2	Discussions with Fire Management Specialist, review of the FMIS database, review of old fire reports
Untrammeled	Authorized actions	1-2. Number of actions to manipulate plants	1	
Untrammeled	Authorized actions	1-3. Number of actions to manipulate wildlife	1	
Untrammeled	Authorized actions	1-4. Number of actions to manipulate insects	1	
Untrammeled	Authorized actions	1-5. Number of actions to manipulate soil	1	
Untrammeled	Authorized actions	1-6. Number of actions to manipulate fish	1	
Untrammeled	Authorized actions	1-7. Number of actions to manipulate pathogens	1	
Untrammeled	Authorized actions	1-8. Number of actions to manipulate water	1	
Untrammeled	Authorized actions	1-9. Number of research, survey, and monitoring projects that manipulate plants, wildlife, or habitat	2	Discussions with Wildlife Biologist and Deputy Refuge Manager, Review of annual report

Quality	Indicator	Measure	Estimated time required to gather and interpret data (1 = minimal, 2 = moderate, 3 = high)	Comments
Untrammeled	Unauthorized actions	1-10. Number of permitted special uses that manipulate the biophysical environment	2	Discussions with Wildlife Biologist and Visitor Services, Review of SUP's
Untrammeled	Unauthorized actions	1-11. Number of unauthorized actions taken by citizen groups, or individuals that influence the community of life inside wilderness	2	Discussions with law enforcement officers
Untrammeled	Unauthorized actions	1-12. Number of unauthorized , human-caused, fires	1	
Natural	Plant and animal species and communities	2-1. Presence of non-native/invasive species index	3	Many hours of field work, researching and implementing an established protocol, interpreting the collected data
Natural	Plant and animal species and communities	2-2. Status of species of particular concern or interest	2	Review of T & E species, discussions with Wildlife Biologist
Natural	Physical resources	2-3. Air quality	1	All data provided by I & M
Natural	Physical resources	2-4. Presence of hazardous contaminants	1	
Natural	Biophysical processes	2-5. Climate change parameters	2	Discussions with Wildlife Biologist, Fire Management Specialist, analysis of weather data required
Natural	Biophysical processes	2-6. Change in natural fire regime	2	Discussions with Fire Management Specialist

Quality	Indicator	Measure	Estimated time required to gather and interpret data (1 = minimal, 2 = moderate, 3 = high)	Comments
Natural	Biophysical processes	2-7. Landscape fragmentation	3	GIS spatial analysis required
Undeveloped	Non-recreational structures, installations, and developments	3-1. Miles of road dividing the wilderness	2	GIS spatial analysis required
Undeveloped	Inholdings	3-2. Acres of inholdings within the wilderness	2	Review of the CCP and WMP required
Undeveloped	Use of motorized or mechanical	3-3. Number of actions requiring a minimum tool analysis	1	Discussions with Refuge management required and review of computer files
Undeveloped	Use of motorized or mechanical	3-4. Authorized emergency uses	1	
Undeveloped	Use of motorized or mechanical	3-5. Incidents of ATV use in the wilderness	2	Discussions with law enforcement officers
Undeveloped	Use of motorized or mechanical	3-6. Miscellaneous unauthorized uses	1	
Solitude +	Remoteness from inside	4-1. Visitors to wilderness areas	2	Discussions with Visitor Services and analysis of counter data required
Solitude +	Remoteness from inside	4-2. Percent of wilderness away from access or travel routes	3	GIS spatial analysis required
Solitude +	Remoteness from outside	4-3. Travel routes adjacent to wilderness	3	GIS spatial analysis required

Quality	Indicator	Measure	Estimated time required to gather and interpret data (1 = minimal, 2 = moderate, 3 = high)	Comments
Solitude +	Facilities that decrease self-reliant recreation	4-4. Miles of authorized trail in the wilderness	3	GIS spatial analysis required
Solitude +	Facilities that decrease self-reliant recreation	4-5. User-created recreation facilities	1	
Solitude +	Mgmt restrictions on visitor behavior	4-6. Management restrictions	2	Review and interpretation fo CCP and WMP required
Other Features	Loss of paleontological or geological resources	5-1. Number of unauthorized removals of paleontological or geological resources	1	
Other Features	Loss of statutorily protected cultural resources	5-2. Number of unauthorized removals of cultural resources	1	

Title of staff involved in identifying, prioritizing, and selecting measures	Staff time to identify, prioritize, and select measures (in whole hrs)	Comments
Refuge Manager	2	Consulted in formal meetings for identification and ultimate selection and definition of measures
Deputy Refuge Manager	6	Consulted in formal and informal meetings for identification, prioritization and ultimate selection and definition of measures
Wildlife Biologist	14	Consulted in formal and informal meetings for identification, prioritization and ultimate selection and definition of measures. Worked closely on which measures best represent the wilderness character.
Fire Management Specialist	2	Informal discussions regarding any measures related to fire management on the Refuge.
Federal Wildlife Officer	2	Informal discussions regarding any measures related to law enforcement on the Refuge.

Time you spent to identify, prioritize, and select all the measures (in whole hours)	Time you spent to learn how to enter data into the WCM database application (in whole hours)	Time you spent to enter all data into the WCM database application (in whole hours)	Time you spent on other tasks directly related to WCM (e.g., reading CCP, giving presentations, talking with staff) (in whole hours)	Time you spent doing <u>other</u> Refuge tasks not directly related to WCM (in whole hours)
170	8	8	100	220

APPENDIX C: DATA SOURCES AND PROTOCOLS FOR ALL MEASURES

Measure	Detailed Description of the Data Source(s) and Protocols for How the Data Were Gathered
1-1. Number of actions to manage fire (natural ignitions and human-caused)	<p>Source: The Refuge Fire Management Specialist and USFWS-FMIS (Fire Management Information Systems) website at https://intranet.fws.gov/fmis/</p> <p>Protocol: Count all natural and human-caused (prescribed) fires that occur in the wilderness annually. Only natural fires that are suppressed within the wilderness boundary should be considered. If a fire is ignited within the wilderness and suppressed outside the boundary, it is not a fire management action. All prescribed burning within the wilderness must also be counted. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-2. Number of actions to manipulate plants	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-3. Number of actions to manipulate wildlife	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-4. Number of actions to manipulate insects	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>

1-5. Number of actions to manipulate soil	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-6. Number of actions to manipulate fish	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-7. Number of actions to manipulate pathogens	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-8. Number of actions to manipulate water	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician, Annual Narratives</p> <p>Protocol: Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\WCM Resources\Wilderness Character Monitoring.</p>
1-9. Number of research, survey, and monitoring projects that manipulate plants or wildlife habitat	<p>Source: The Refuge Wildlife Biologist and/or Biological Technician</p> <p>Protocol: Use professional judgment to determine which projects impact plant and wildlife habitat. The following processes can serve as a general outline in accounting for all related actions:</p> <ul style="list-style-type: none"> • Review of all special use permits relating to research, survey, and monitoring projects • Interview Refuge staff about any internal research, survey, and monitoring projects • Review the annual narrative

1-10. Number of permitted special uses that manipulate the biophysical environment	<p>Source: Refuge visitor center staff files</p> <p>Protocol: All yearly special use permits assigned to the wilderness area can be requested through visitor services. Each individual permit will be counted as a permitted special use that manipulates the biophysical environment. Permits can currently be found at the following address: S:\Special Use Permits\~Special Use Permit Log and SUP Forms\Special Use Log FY12.docx.</p>
1-11. Number of unauthorized actions taken by citizen groups, or individuals that influence the community of life inside wilderness	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
1-12. Number of unauthorized , human-caused, fires	<p>Source: The lead Federal Wildlife Officer, Fire Management Specialist, and the USFWS-FMIS (Fire Management Information Systems) website at https://intranet.fws.gov/fmis/</p> <p>Protocol: Count all unauthorized, human-caused, fires that are ignited within the wilderness or ignited elsewhere and then burn into the wilderness boundary. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality.</p>
1-13. Incidents of unauthorized horse riding	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
2-1. Presence of non-native/invasive species index	<p>Source: The Refuge Wildlife Biologist</p> <p>Protocol: Refer to the National Wildlife Refuge System <i>Adaptive Management of Invasive Forest Plants Project Record</i>. See Appendix 6: Grid-Scale Monitoring Protocol. Results from the initial monitoring effort over the summer of 2012 were calculated using Microsoft Excel. Data file can be found at: G:\BIO\GIS\Invasive Species Monitoring\InvasivePlantsProject_Wilderness_Master File.</p>

2-2. Status of species of particular concern or interest	<p>Source: Crab Orchard NWR Comprehensive Conservation Plan, Refuge Wildlife Biologist</p> <p>Protocol: Review the current listings of T & E species for Illinois and the surrounding states. Collaborate with the Wildlife Biologist and Refuge Management for which species have been or are likely to be found at Crab Orchard. The listing of T & E species can be found at the following address: http://www.fws.gov/endangered/.</p>
2-3. Air quality	<p>Source: FWS NWRS Branch of Air Quality</p> <p>Protocol: All data required will be provided by the FWS NWRS Branch of Air Quality. Data values reported represent the 5-year averages for each metric.</p>
2-4. Presence of hazardous contaminants	<p>Source: CERCLA files</p> <p>Protocol: Confirm with Environmental Contaminants staff if there are any hazardous contaminants found in the Wilderness boundary. This may require some professional judgment if no formal survey is implement inside the wilderness, but contaminants are found on surrounding lands and water bodies. Count each type contaminant for monitoring purposes.</p>
2-5. Climate change parameters	<p>Source: Crab Orchard's Remote Automated Weather Station (RAWS) data found at: http://raws.wrh.noaa.gov/cgi-bin/roman/meso_base.cgi?stn=COWI2.</p> <p>Protocol: Using Microsoft Excel, analyze weather data for the following records: mean summer temperature, mean winter temperature, and total winter precipitation. Summer is defined as the months of June, July, and August. Winter is defined as the months of December, January, and February. Mean summer and winter temperatures should be calculated for each year. These seasonal means are then averaged over a five-year time interval. Since the year changes in the middle of the winter season, mean winter temperatures for any given year are calculated using data from December of the previous year and data from January and February of the target year. Total precipitation is calculated for the winter months and then these seasonal totals are averaged over a five-year time interval.</p>
2-6. Change in natural fire regime	<p>Source: The Refuge Fire Management Specialist</p> <p>Protocol: Refer to <i>The Guide to Using FMIS</i>. The Fire Management Specialist or the next most qualified person available should be consulted when selecting regime conditions. The regime conditions will only be altered if a fire has occurred in the Wilderness.</p>
2-7. Landscape fragmentation	<p>Source: Refuge GIS data</p> <p>Protocol: Utilizing spatial analysis tools such as GIS, measure the linear distance of wilderness boundary adjacent to land that is managed by an entity other than the Fish and Wildlife Service or for purposes inconsistent with wilderness goals. This requires a level of professional judgment and knowledge of the current land practices implemented by private landowners adjoining the Wilderness.</p>

3-1. Miles of road dividing the wilderness	<p>Source: Refuge GIS data files</p> <p>Protocol: Personal observation or review of the Refuge GIS files.</p>
3-2. Acres of inholdings	<p>Source: Refuge management</p> <p>Protocol: Review of the CCP shows the history of the two parcels within the Wilderness that do not hold wilderness designation and their current ownership by the Refuge. Discussions with refuge management regarding these parcels will be sufficient in determining their status in future data collection.</p>
3-3. Number of actions requiring a minimum tool analysis	<p>Source: Refuge data files – minimum tool analysis</p> <p>Protocol: Use professional judgment to determine the minimum tool analyses that are unrelated to emergency uses. The following processes can serve as a general outline in accounting for all related actions:</p> <ul style="list-style-type: none"> • Review of all minimum tool analyses conducted over the past fiscal year • Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>, to determine what is counted as one action or many. • Total all actions requiring a minimum tool analysis
3-4. Authorized emergency uses	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
3-5. Incidents of ATV use in the wilderness	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammelled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>

3-6. Miscellaneous unauthorized uses	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
4-1. Visitors to wilderness areas	<p>Source: Visitor Services</p> <p>Protocol: The visitor services staff utilizes a software program for interpreting data collected by the trail counters. Visitor use is broken down by number of monthly, weekly, and daily visitors along with average visitors per day. This measure only considers total visitors per year.</p>
4-2. Percent of wilderness away from access or travel routes	<p>Source: Refuge GIS files</p> <p>Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the percentage of wilderness away from access or travel routes. Utilizing ArcGIS, an analyst must perform the following task in order to calculate the percentage of wilderness away from access or travel routes:</p> <ol style="list-style-type: none"> 5. Acquire GIS layers for all travel routes – one for trails, one for roads, and shoreline accessible to the wilderness. 6. Create a buffer of appropriate size around each travel route. 7. Subtract the buffers from the wilderness polygon using the erase tool. 8. Calculate the area of remaining wilderness after all the travel route buffers have been erased. <p>The following distances away from access and travel routes were subjectively chosen for the Crab Orchard Wilderness:</p> <ul style="list-style-type: none"> • Active recreation trails and gas motor-prohibited waterways inside or adjacent to wilderness – 100 m • Lake shore allowing wilderness access by motor boat – 200m • Open automobile roads – 300 m <p>Refer to the guidelines set forth on pages 188-191 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i> for further information. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring. Baseline GIS analysis can be found at: G:\BIO\Wilderness Character Monitoring\Crab Orchard NWR\GIS\WCM_Travel_Routes.mxd</p>
4-3. Travel routes adjacent to wilderness	<p>Source: Refuge GIS files</p> <p>Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the mileage of roads and shorelines adjacent to the Wilderness.</p>

<p>4-4. Miles of authorized trail in the wilderness</p>	<p>Source: Refuge GIS files and Visitor Center Park Rangers</p> <p>Protocol: A spatial analysis, using Refuge GIS data, must be performed to calculate the miles of authorized trail in the wilderness. Utilizing ArcGIS, an analyst must perform the following tasks in order to calculate distance:</p> <ol style="list-style-type: none"> 4. Acquire GIS layers for all official trails. 5. Separate the trail within the Wilderness boundary using the clip tool. 6. Use the measure tool to determine total length. <p>If any new trail or alteration to the existing trail is authorized by the Refuge Manager, a new shapefile of the route may need to be created using a GPS.</p>
<p>4-5. User-created recreation facilities</p>	<p>Source: Personal observation, lead Federal Wildlife Officer, and law enforcement database</p> <p>Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions for the untrammeled quality. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
<p>4-6. Management restrictions</p>	<p>Source: CCP and Wilderness Management Plan</p> <p>Protocol: This measure is a simple count of the management restrictions set-forth for the Crab Orchard Wilderness. Discussion with the Refuge Managers should be sufficient in determining any changes in management restrictions.</p>
<p>5-1. Number of unauthorized removals of paleontological or geological resources</p>	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>

<p>5-2. Number of unauthorized removals of cultural resources</p>	<p>Source: Lead Federal Wildlife Officer and law enforcement database</p> <p>Protocol: Request this information from the lead law enforcement officer; access to the database is only permitted for law enforcement personnel. Measures monitored by refuge law enforcement officials are recorded as “incidents”. In the case of wilderness character monitoring, “incidents” will be considered the same as “actions”. Refer to the guidelines set forth on page 55 of the Forest Service <i>Technical Guide for Monitoring Select Conditions Related to Wilderness Character</i>. See Table 11 for general rules for counting and reporting number of actions. The FS Technical Guide can be found at G:\BIO\Wilderness Character Monitoring\FWS Wilderness Fellows Resources\Wilderness Character Monitoring.</p>
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